

# Valuation of Childhood Risk Reduction: The Importance of Age, Risk Preferences, and Perspective

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This article explores two problems analysts face in determining how to estimate values for children's health and safety risk reductions. The first addresses the question: Do willingness-to-pay estimates for health risk changes differ across children and adults and, if so, how? To answer this question, the article first examines the potential effects of age and risk preferences on willingness to pay. A summary of the literature reporting empirical evidence of differences between willingness to pay for adult health and safety risk reductions and willingness to pay for health and safety risk reductions in children is also provided. The second dimension of the problem is a more fundamental issue: Whose perspective is relevant when valuing children's health effects—society's, children's, adults-as-children, or parents'? Each perspective is considered, followed ultimately by the conclusion that adopting a parental perspective through an intrahousehold allocation model seems closest to meeting the needs of the estimation problem at hand. A policy example in which the choice of perspective affects the outcome of a regulatory benefit-cost analysis rounds out the article and emphasizes the importance of perspective.

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**KEY WORDS:** Benefit-cost analysis; children; risk valuation; willingness to pay

## 1. INTRODUCTION

Policymakers regulating health and safety risk are often required to assess the economic efficiency of a regulation by conducting a benefit-cost analysis. A recent executive order, E.O. 13045: "Protection of Children from Environmental Health Risks and Safety Risks," directs U.S. federal agencies to identify, assess, and address health and safety risks that disproportionately affect children. This introduces a need for estimates of the economic value of

reducing risks to children for use in benefit-cost analyses.

For benefit-cost analysis to be meaningful, these value estimates should reflect the preferences of the individuals affected by the regulation. Benefit-cost analysis, and welfare economics generally, is based on the presumption that individuals are the best judges of their own welfare and make decisions, using available information and resources including time and income, that reflect what they believe to be in their best interest. These decisions will involve tradeoffs between a number of different commodities including health and safety risks, and it is from these tradeoffs that economists infer how individuals value changes in risk. While there are many ways to frame these tradeoffs, values are typically measured as the *ex ante* willingness to pay (WTP) for a

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reduced risk to safety or health, or as *ex ante* willingness to accept compensation (WTA) for an increase in such risks.<sup>2</sup> The *ex ante* perspective for valuation more closely matches a regulatory context in which decisions are made about how to reduce the probability and/or severity of an adverse event and not about how to compensate those who have experienced the event. WTP and WTA values are generally derived from adult-based studies of behavior and risk preferences.

The recent directive aimed at children, however, will undoubtedly lead to more benefit-cost analyses of the effects of policies on *children's* health. Despite the fact that the economics literature is replete with values for adult health risk reductions, relatively little information is available on children's health valuation. As a result, no distinctions are generally made between values applied to risk reductions for children and those applied to risk reductions for adults, even though they are likely to differ for a number of reasons. Often, the practice among government policy analysts is to transfer unadjusted willingness-to-pay values estimated for adults to children.<sup>(1,2)</sup> If the value of reducing risks to children's health does indeed differ from that of adults, this practice may bias the conclusions of the economic analysis and result in inefficient policy choices.

In general, the underlying factors creating potential gaps between adult and child health benefit values can be divided into risk differences and valuation differences. Children and adults may differ in their exposures to potentially harmful substances and to potentially dangerous situations. They may also differ in the nature and magnitude of health effects arising from identical exposures due to physiological and metabolic differences, as well as differences in post-exposure behaviors. Both of these possibilities result in *risk differences* between children and adults. However, even when adults and children experience otherwise identical risks, the *economic value* associated with reducing health risks to children may be systematically distinct from the value placed on reducing these same health risks to adults. This possibility falls into the category of *valuation differences*.

The purpose of this article is to explore the potential valuation differences associated with

health risks experienced by children and adults and, in particular, how one may need to approach analysis differently for the two groups. Because the most obvious difference between adults and children is the age of each group, we begin by reviewing research into whether and how the age of a population experiencing a health outcome affects valuation. The economics literature has addressed aspects of this question in a variety of contexts, but the implications for children's health valuation are limited. We also explore the effects of risk preferences on the values for health risk reductions experienced by children and argue that these too may lead to differences in values compared to those for adults. We then address a more fundamental issue: Whose perspective is relevant when valuing children's health effects—society, children, adults-as-children, or parents? Finally, we consider the policy implications of our discussion.

## 2. WILLINGNESS TO PAY FOR HEALTH RISK REDUCTIONS IN CHILDREN VERSUS ADULTS: WHAT DO WE KNOW?

The literature on valuation of health risk reductions has grown tremendously in the last two decades, with research examining job-related risks, transportation risks, safety-product markets, and age effects. Although very few of these studies focus on children, we can gain some insight regarding the implications for children's health valuation from their findings. One particular area where there has been a great deal of applied work is in research on valuing fatal risks, often measured by the value of a statistical life (VSL). VSL estimates suffer theoretical and empirical shortcomings as measures of value,<sup>(3)</sup> but they are widely used in applied benefit-cost analysis.

### 2.1. The Effects of Age

Most studies estimate values for own health risk reductions in adult populations, specifically adults ranging in age from 20 to 70 years old. Few of these studies, however, explicitly control for the effects of the age of the adult in question on willingness to pay to reduce risks to life and limb. Those studies that do consider age find that willingness to pay peaks at approximately age 40 and then decreases with age.<sup>(4)</sup> Other studies have not controlled for age explicitly, but have embedded in their models assumptions about the effects of age on WTP. Rowe *et al.*<sup>(5)</sup>

<sup>2</sup>This is how, for example, the Environmental Protection Agency defines its approach to measuring benefits in its 2000 *Guidelines for Preparing Economic Analyses*.<sup>(1)</sup>

examine the implications of model choice and assumptions on VSL estimates as age increases. Specifically, they calculate VSL estimates at various ages, using four different models from the published literature, and report these values as a percentage of the standard VSL estimate calculated for a 40 year old. These values are then compared to a constant-value-of-statistical-life-year approach. The models used in this comparison include a contingent valuation study that explicitly controls for age,<sup>(4)</sup> a hedonic wage study that discounts future values of risk reductions,<sup>(6)</sup> and a study of life-time consumption.<sup>(7)</sup> Their findings are plotted in Fig. 1. In short, Rowe *et al.* find that VSL estimates decline after age 40 or 45 regardless of the model used in the original study, although the rate at which these estimates decline is model dependent.

The effect of age on VSL at ages *below* 40 is much less certain. At age 20, for instance, estimates range from 40% of the VSL at age 40 to close to 160%. The implications for valuing risks to children are not addressed in any of these models, however, save for the constant-value-of-life-year approach. This approach suggests that the VSL for children will be larger than that for adults because, all else equal, children have a larger number of remaining life years. While this argument may make intuitive sense, there is no empirical support to lend credence

to this notion. In fact, studies examining VSL at later stages in life indicate that although VSL estimates decrease with age, the values decrease much less rapidly than expected under a linear life-year model.<sup>(4,8)</sup> Since statistical life-years do not appear to have a constant value at these later stages in life, we cannot make any inferences regarding their value at early stages of life.

While one could attempt to extrapolate VSL estimates to children of various ages using the shape of any one of the remaining functions in Fig. 1, it is not clear which model is the most appropriate. Clearly, the model choice will have serious implications for the value of risk reductions experienced by children. Furthermore, simply extrapolating values to children of different ages ignores other factors that are likely to cause deviations from adult values, such as differences in risk preferences and the context in which risk tradeoffs are made.

## 2.2. The Effects of Risk Preferences and Risk Reducing Behaviors

Preferences about risk and risk reducing behaviors suggest several additional reasons to expect differences between values for adult risk reductions and those for children. First, there is some evidence that society is more averse to risks experienced by children than to those experienced by adults. Evidence of this can be found in U.S. laws such as those on bicycle helmet use that apply only to children (of various age ranges) and the Food Quality Protection Act of 1996, which requires an additional tenfold margin of safety for children to ensure that they face no harm from aggregate exposure to pesticide and chemical residues in food. While the risks faced by adults and children may differ considerably in these two examples, the level of protection mandated for children suggests that, as a society, we are more risk averse in the case of children. Greater risk aversion suggests that risk reductions experienced by children will be valued more highly than similar reductions in adults.

Second, the degree to which risks are voluntarily accepted is thought to influence willingness to pay, with research suggesting that individuals prefer risks that are voluntary.<sup>(9,10)</sup> One could argue that the issue of voluntariness is much more important in the case of children because in some sense all risks to children are involuntary since risk exposure decisions are made for them. Whereas adults are able to consciously take measures to protect

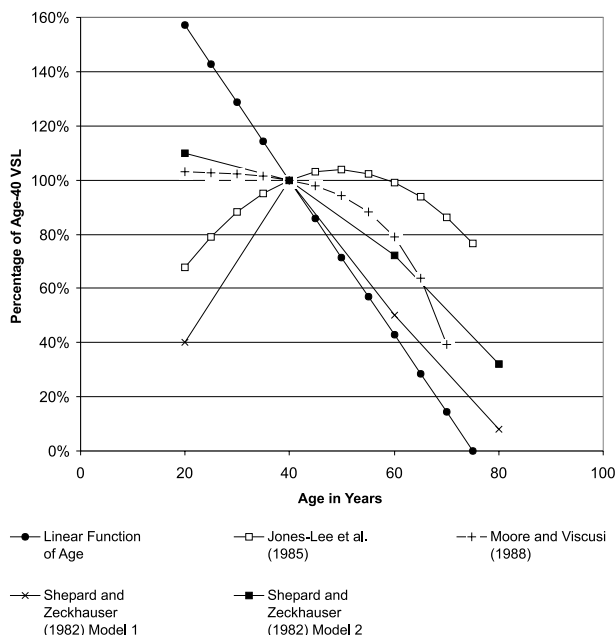


Fig. 1. Value of a statistical life as a function of age.

Note: Reproduced from Rowe *et al.*<sup>(5)</sup>

themselves against exposures, children rely on adults to make these sorts of decisions.

Finally, the uncertainty surrounding the risk estimate may itself have an effect on the value individuals place on risk. Economists distinguish risk from uncertainty about risk, terming the latter “ambiguity.” Individuals appear to exhibit ambiguity aversion, preferring certain risks to those that are less certain.<sup>(11)</sup> It is reasonable to expect that in situations where adults and children face risks of similar magnitude, that the children’s risk estimate is likely to be much less certain. This follows from the fact that, for ethical reasons, children are excluded from the pool of subjects available for clinical trials of harmful exposures and do not face occupational exposures as do adults. As such, much less is known about the physical response of children to exposures to some pollutants. To the extent that parents must balance relatively well-defined risks to themselves against relatively ambiguous risks to their children, ambiguity aversion would lead them to prefer reducing the latter, all else equal.

### 2.3. The Empirical Evidence

While the discussion above may suggest that the value of reducing health risks to children differs from that of adults and that it may in fact be higher, few studies actually gather such evidence. In fact, only a handful of studies estimate values for both adults and children so that such a comparison can be made, and the findings across these studies are not consistent.<sup>3</sup> Jenkins, Owens, and Wiggins,<sup>(14)</sup> for instance, estimate adult and child VSLs based on purchases of bicycle helmets and the risk reductions realized by average use of the helmets. They estimate VSLs under three different use scenarios for three different age groups: 5 to 9, 10 to 14, and 20 to 59 years old. VSL estimates for the adults range between \$2 and 4 million while estimates for children are lower under each of the scenarios and range between \$1.1 and 2.7 million. Interestingly, estimates for older children tended to be lower than for younger children.

On the other hand, Liu *et al.*<sup>(15)</sup> estimate both a mother’s willingness to pay to prevent her child from having a cold as well as her willingness to pay to

prevent the same illness in herself. While clearly not focused on mortality risk, the authors find that mothers in this sample are willing to pay more, on average, to protect their children’s health than to protect their own.

Although the evidence regarding the magnitude of a value of a statistical child’s life in the economics literature is sparse, a small body of empirical evidence in the public health literature suggests higher values for reduced risks to children. Williams<sup>(16)</sup> examined U.K. data from the York Health Evaluation Survey, administered to 377 randomly selected York residents, and found that respondents believe health benefits are more valuable when bestowed upon infants or adults who are rearing children than when bestowed upon people in other stages of life. Along similar lines, Busschback, Hessing, and DeCharro<sup>(17)</sup> surveyed 30 students and 35 elderly people to inquire about the importance of health at different life stages. Respondents believed being healthy during childhood was approximately twice as important as being healthy during the last decade of life. In another study, Lewis and Charny<sup>(18)</sup> asked 721 respondents to choose between saving one of two individuals who differ only in their age. They found that, by a ratio of 84 to 1, respondents preferred that a five year old receive life-saving treatment over a 70 year old. Interestingly, Lewis and Charny also found that, by a ratio of 5 to 3, respondents would rather have an eight year old receive life-saving treatment than a five year old. Respondents reported concern that an older child is more likely to understand what is happening to him or her and is therefore likely to experience greater distress than a very young child.

While the age of a “statistical” person is likely to affect the relative value placed on reducing fatal risk, the relationship between age and value for a risk reduction is a potentially complicated one. Valuation may hinge on life stages rather than age *per se*. This suggests a nonlinear relationship between age and health risk valuation that merits additional research.

### 3. FROM WHOM SHOULD WE ELICIT VALUES FOR RISK REDUCTIONS TO CHILDREN?

While all the above considerations will affect WTP for risk reductions, a rarely discussed, more fundamental question is: To whom should one look when valuing children’s health? The answer to this

<sup>3</sup> Several studies estimate values for reductions in children’s health and safety risks but draw conclusions regarding the magnitude of their estimates based on out of sample comparisons to adult values.<sup>(12,13)</sup>

question will depend in part on the nature of the value that is ultimately sought. From a public policy perspective, societal willingness to pay is desirable. However, the ability to accurately assess and measure societal willingness to pay will be determined by how successfully one can distinguish between various types of altruism. If this distinction cannot be made, the potential for double-counting benefits exists, as explained in more detail below.

Societal preferences aside, the next best approach is to measure individual willingness to pay for reductions in children's health and safety risk. Ideally, we wish to estimate the value for a given risk reduction that children themselves would pay if they had mature reason and financial resources. Because children generally fail to meet both these conditions, researchers must often change the focus of their inquiry and opt instead to estimate childhood risk values using the willingness to pay of individuals who have the long-run best interests of the child at heart.

In short, other than the societal perspective, there are at least three perspectives to consider when assessing child risk values—that of children themselves, adults-as-children, and parents. By adults-as-children we mean adults assessing the value of risk reductions that may have occurred during childhood. Each of these perspectives succeeds in measuring the desired values to a greater or lesser extent than the rest. We examine each perspective below and discuss differences in their validity, use, and practicality for welfare economics.

### 3.1. Society and Social Altruism

From a public policy viewpoint, the most desirable measure of welfare is social welfare. A measure of social welfare arising from a reduction in health or safety risks encompasses not only the values that individuals place on their own health or safety, but also the values that individuals place on reducing health and safety risks in other people. These latter, altruistic preferences are particularly difficult to measure because they are difficult to separate out from individual preferences concerning own health and safety. For children, however, the values associated with altruism may be substantial.<sup>(19)</sup> Even if altruistic preferences could be separated from preferences regarding self, researchers would need to be able to distinguish between two types of altruism in order to avoid double-counting benefits: paternalistic (or safety-focused) altruism, and nonpaternalistic (or preference-respecting) altruism.

If individuals gain utility from providing a new safety program for children but do not honor children's preferences (or a proxy for children's preferences, such as parents' preferences for their own children's safety) for the program, then they are said to exhibit paternalistic altruism. In this case, it is appropriate to incorporate these altruistic values in assessments of social welfare. These values can be added to the children's values for their own risk reductions (or a proxy for them) without double counting. Society, in this example, does not care about how children (in most cases through their parents or caregivers) must adjust their spending to accommodate the new safety program but only that the new program is in place.

If individuals honor the preferences of those affected by the safety program, they are said to exhibit nonpaternalistic (or preference-respecting) altruism. In this case, individuals are mindful not only of the risks experienced by children, but also of the costs new health and safety requirements will impose on households. For example, if a proposed government program were expected to impose costs to the entire population, the portion of an individual's WTP for the program that is motivated by altruistic concern for someone else's children will increase costs (perhaps through increased taxes) to parents of those children. This, in turn, could reduce parental spending on other goods and services the children need. The altruistic individual in this case does not completely pay for the benefit he or she is asked to value, and is concerned about the costs that will be borne by parents. As such, adding the individual's WTP to that of parents will amount to double counting parents' preferences. Only when the altruistic individual is willing to pay for the good in its entirety and transfer the purchased good to another individual free of charge is it appropriate to incorporate nonpaternalistic altruism in the welfare measure.

Double-counting issues also arise when considering adult health in a social welfare context, and open questions exist about exactly how societal preferences for children's health might diverge from societal preferences for adult health. Nonetheless, the implications for policymakers are limited. Society's perspective is rendered impractical due to the virtual impossibility of distinguishing between paternalistic and nonpaternalistic altruism. Instead, economists generally characterize welfare changes by aggregating each individual's WTP for one's *own* health in the affected population, leaving out the altruism component.

### 3.2. Children as Economic Decisionmakers

According to traditional welfare economics, risk reductions for adults should be valued according to the principle of consumer sovereignty. Under this principle, the value of risk reductions—large or small—is best approximated using the value individuals themselves place on them. Individuals know best how to allocate their own resources; therefore, self-assessed values for risk reductions are the preferred valuation measure.

For children, especially young children, the principle of consumer sovereignty is inappropriate. Children do not possess the maturity to make decisions concerning their health and safety; they lack well-defined preferences over the full range of alternatives necessary to make reasoned choices; and they lack the cognitive ability to make such choices. Children, particularly young children, are generally unable to comprehend death and the notion that death is irreversible.<sup>(20)</sup> Furthermore, because willingness to pay includes the concept of “ability to pay,” one must consider that children do not have control of the financial resources required to make tradeoffs between income and health or safety. As a result, a child must rely on adults (typically parents or other caregivers) to monitor and make these decisions for him or her. These reasons suggest the need to elicit from adult economic agents the values of risk reductions experienced by children.

### 3.3. Adults as Children

Another perspective from which to assess values of childhood risk reductions is what we term the “adults-as-children” perspective. This perspective requires adults to place themselves in the position of children or, alternatively, asks adults about preferences they currently exhibit as they think back to their own childhood and the risks they faced.<sup>(21)</sup> Adults could then be asked to look back in time and assess what a risk reduction in their childhood would be worth.

The goal of this approach is to have an adult consider risks he or she may have faced as a child and answer the question: What are you willing to pay for a risk reduction 30 years ago?<sup>3</sup> One difficulty

with this approach is the possibility that an adult will not entirely accept the hypothetical scenario and as a result responds based on his *ex post* position where childhood risks are not, in fact, risks at all because time has resolved the lottery. One would expect such responses to be large if the effect has occurred and zero if it has not, and the resulting values may be more akin to an *ex post* measure of compensation than to an *ex ante* willingness to pay for a risk reduction. While *ex post* measures can be used in benefit-cost analysis,<sup>(22)</sup> most benefits are likely to be *ex ante* types of measures and aggregating the two types of measures would be problematic. In any case, the analyst must be able to identify the type of benefit measure being elicited from respondents.

An alternative starting point for generating values under this perspective may be to discount existing estimates of an adult’s WTP for an immediate risk reduction back to the age of the child facing the health risk. This approach is, in effect, the inverse of considering latency periods in valuing risks from carcinogens or other hazards with lagged effects. Among other assumptions implicit in this approach is that current WTP for an immediate risk reduction is unchanged and that the adult value is applicable once it has been time-adjusted. In practical terms such an approach could have a large effect on the value of risk reductions commonly used in public policy. At a discount rate of 3%, for example, this procedure results in a childhood VSL at age 10 that is 240% that of its base adult (age 40) value.

Another alternative is to construct value estimates that provide some sort of bound on what a child might express as WTP if that child was a rational economic decisionmaker. An estimate based on the value of human capital is one possibility. For example, if an early intervention leads to greater expected life-time earnings, one might reasonably assume that this hypothetical child would be willing to pay up to the present value of those larger returns to secure them.

While determining the value of human capital in the labor market falls within the realm of mainstream economics, there is relatively little literature to guide an approach based on the adults-as-children perspective more generally. It is also unclear what this perspective means in the context of existing theoretic economic models. Life-cycle consumption models, for example, provide a framework for consistently considering mortality risks and payments separated in time, but these models are inherently forward-looking.

<sup>3</sup>This is an extremely difficult question to both develop and answer. To our knowledge, no study has attempted to elicit such values, likely for just this reason.

### 3.4. Parents as Economic Decisionmakers for Children

Parents are a natural alternative to children for health risk value solicitation. The sparse existing research that has estimated WTP for reducing risks to children has measured the preferences of parents, guardians, or, in one case, adults living in the same household as children. While several of these studies simply produce estimates from a parental perspective with no theoretical justification, others have presented theoretical models that suggest the parents' choice as the appropriate source of information. These include utility maximization models, where the individual of concern is a parent or guardian, and household production models. A third alternative, although it has not been widely used in the literature in the present context, is an intra-household allocation model.

#### 3.4.1. Utility Maximization Models

In utility maximization models, an individual's utility is a function of consumption and other factors, and is typically maximized subject to a budget constraint. Where these models have been used to value child risk reductions, either individual utility is examined or a parent's utility is specified as being dependent on the health of the child.

Viscusi, Magat, and Huber,<sup>(23)</sup> Evans and Viscusi,<sup>(24)</sup> and Viscusi, Magat, and Forrest<sup>(19)</sup> present various results of a survey designed to estimate values for changes in risks to household members from two pesticides used at home. The authors consider two subsamples of respondents, those living with children under age five and those living without children of this age. However, the theoretical model underlying the empirics is based on an individual, not a household utility function, and there is no discussion of the appropriate perspective from which to assess reductions in risk to children. In fact, in the subsample of respondents living with young children, no attempt is made to restrict the sample to parents or guardians.

Carlin and Sandy<sup>(12)</sup> estimate the value of a statistical child's life by observing car-seat usage by mothers of young children. They develop an expected utility model in which the mother's utility depends on a number of variables, including the child life-saving activity and a comprehensive variable reflecting the joys and toils of child rearing. Maximizing expected utility subject to a budget

constraint, they derive an equation for the mother's value of reducing risks to her own child, which is estimated with data including mother's wages (real or imputed) and car-seat usage. In a footnote, they state that fathers' preferences might influence mothers' behavior and to the extent that they do, the estimated WTP moves closer to a parental value, rather than a maternal one.

Liu *et al.*,<sup>(15)</sup> while not explicitly presenting a utility maximization model, use a contingent valuation survey to estimate mother's WTP to avoid a cold as well as her WTP to have one of her children avoid the same illness. They provide no justification for using the mother's perspective but emphasize the comparison of mother's "private" WTP for own health to mother's "altruistic" WTP for her own child's health.

Utility maximization is also implicit in the examination by Jenkins, Owens, and Wiggins<sup>(14)</sup> of the market for child bicycle safety helmets. They estimate parental WTP for reduced risks to children and offer two reasons to avoid modeling a child's own WTP for reduced risk. First, children generally have no wealth with which to make purchasing decisions. Second, when it comes to safety, children receive guidance from caregivers regarding appropriate actions to limit safety risks (e.g., wear a helmet while bike riding, don't play in the street). Since parents are the decisionmakers in child safety product markets, measuring parental WTP for child safety, it would seem, is the appropriate practical alternative to measuring a child's own WTP.

#### 3.4.2. Household Production Models

Unlike simple utility maximization models, household production models use the household as the unit of observation rather than the individual. That is, WTP for health and nonhealth goods is decided by the household and constrained by household income. Household production models are further characterized by the specification of technical relationships among input goods and final services produced by the household. Children's health risks in these types of models are typically specified as outputs of household production.

Joyce, Grossman, and Goldman<sup>(13)</sup> estimate social willingness to pay for increases in neonatal survival rates resulting from increases in ambient air quality. They present a household production model in which parental utility depends upon consumption, the number of children, and the survival probability

of each child. The household produces neonatal survival probability by combining air quality, birth weight, and other variables. An equation is derived for parental WTP for improved air quality, which is the objective for empirical estimation; albeit an objective that proves elusive. The nature of their data (which includes medical costs covered by insurance) leads the researchers to present their estimate as social rather than parental WTP.

Agee and Crocker<sup>(25)</sup> examine parents' decisions to treat their children's body burdens of lead and estimate parental willingness to pay for reduced burdens. In their model, household utility depends on consumption and the parents' perceived risk that their child will become chronically impaired by lead exposure. The household affects the child's risk level through actions to reduce lead exposure and medical treatment to reduce body lead burdens. Agee and Crocker derive a demand function for lead treatment from which parental WTP can be derived.

### 3.4.3. Intrahousehold Allocation Models

Intrahousehold allocation models are similar to household production models in that spending decisions are made at the household level subject to a budget constraint. Whereas household production models include specifications for outputs created within the household, intrahousehold models attempt to describe relationships among household members and how these relationships contribute to the allocation and use of resources among family members. Intrahousehold allocation models may incorporate a household production function, but are primarily concerned with the distribution of resources among household members. Within an intrahousehold allocation model with children present, parents make decisions that affect all family members.

Behrman, Pollak, and Taubman<sup>(26)</sup> describe the different forms intrahousehold allocation models have taken. Consensus parental preference models assume that the parents act as if they are maximizing a single utility function, subject to appropriate constraints. The parents' utility function reflects the preferences of the parents, not the children, although the parents are usually assumed to be "altruistic" in the sense that their utility depends on outcomes (or utilities) experienced by their children. In many consensus parental preference models, children are assumed to be passive. However, there are a few examples in which children are modeled as

active, independent decisionmakers. In these, parents influence the behavior of their children by conditioning certain parental decisions (e.g., bequests) on their children's actions.

Nonconsensus parental preference models of intrahousehold allocation also exist. These nonconsensus approaches view household behavior as the outcome of either a noncooperative or a cooperative game. Generally, the purpose of these models has been to allow the two adult household members to disagree. Thus far, nonconsensus models have generally focused on interactions between husbands and wives rather than those between parents and children or only among children.<sup>(26)</sup>

Browning and Chiappori<sup>(27)</sup> develop a rigorous theoretical structure for considering intrahousehold allocation and provide a basis for determining whether a household acts as if there is a single decision-making unit, two such units, or even more. The authors note that this model could be applied to households consisting of adults with children. If observable behaviors suggest the presence of more than two decision-making units in such a household, then one can conclude that at least one of the children plays an active role in household decisions.

A relevant application of an intrahousehold allocation model is given by Mount *et al.*,<sup>(28)</sup> which develops a model in the context of automobile safety. This model is coupled with a hedonic price function for automobiles to estimate the average VSL for three different types of households: those with no children and no retired members; those with children; and those with retired member(s) and no children. As with other revealed preference studies, the perspective adopted is parental. The reason given for choosing this perspective and following this approach is that children are not economic decisionmakers whose preferences can be analyzed to determine an efficient allocation of society's resources regarding their own health and safety.

A model of intrahousehold allocation seems to provide the most complete and intuitive alternative to valuing children's health risks because it captures the tradeoffs made within the household to accommodate illness and injury. In response to a child's illness, for example, parents may divert resources away from activities contributing to family income or to the human capital of another child. Accounting for these types of household reactions is important to assessing the benefits of a public policy that improves child health or safety. Spending changes within the household could affect the distribution of



a policy's benefits and have implications for the policy's effectiveness.<sup>(29)</sup> For example, a policy intended to reduce risks to children might not actually do so if households respond by redirecting funds toward adult consumption that were previously spent on child health or safety.

In spite of its strengths, modeling WTP for child health within an intrahousehold allocation model does not fit entirely into the paradigm constructed by *traditional* welfare economic theory because the child in these models is not the primary decision-maker regarding his or her own health outcomes. The consensus parental preference model with active children comes closest to satisfying welfare economic theory. However, practical knowledge of the nature of the relationships between household members and how they affect willingness to pay for reductions in health risks to individual household members remains very limited. As a result, we cannot say *a priori* what the family structure means for the relative magnitude of adult and children's values for health risk reduction. Future research should examine the importance of children's preferences in family decision making. The requirements for such research have been explored by Browning and Chiappori (1998) and include having data on more goods than family members.<sup>(27)</sup>

### 3.5. Discussion of Perspective

Of the four potential perspectives for assessing childhood risk values, the parental perspective is most advantageous for estimating *ex ante* WTP for childhood risk reduction within the framework of welfare economics. Society's perspective is almost impossible to adopt due to problems distinguishing between paternalistic and nonpaternalistic altruism. On the other hand, the perspective of children themselves fails to meet the welfare economic criteria for decisionmakers to have mature reason and financial resources.

Like the parental perspective, the adults-as-children one meets the researcher's objective of estimating childhood risk values from the WTP of individuals who have the long-run best interests of children at heart. For example, adults assessing the value of risk reductions that would have occurred during childhood have mature reason and are assessing risks that affected themselves, although they may have difficulty accepting the *ex ante* nature of the questions. However, the approach lacks an underlying theoretical structure to guide empirical work.

In the end, the parental perspective seems closest to meeting the needs of the estimation problem at hand. Parents seem likely to be motivated by a genuine concern about their child's life-long happiness and satisfaction. Additionally, the parental perspective is not affected by the serious limitations affecting the others.

Once a parental perspective is chosen, a researcher has a choice regarding how to model that perspective. Of the household models currently in use, the intrahousehold allocation model provides the most promise in that it more effectively captures the important factors affecting parental WTP for child health. The extent to which such models generate empirical results that differ from less detailed models is an open question. Nevertheless, they have the advantage of placing decision making within the context of the household and accounting for how households reallocate resources in response to health and safety expenditure decisions.

It is possible, however, that parents might not always be motivated to make decisions in a child's best interests or that parents face information deficiencies. If this is the case, parental values for child risk reductions may be incomplete or biased, a concern suggested by some of the empirical work on child health valuation.<sup>(12,13,30)</sup> Such concerns may be considered independently of the allocation of household resources to the child by restricting attention to how, for any given allocation to the child, the parents' decisions for the child match what the child's optimal decision would be if the child could make such choices maturely.

The various motivations behind parents' decisions may influence the values they place on children's risk reductions. One potential motivation is concern about self in old age. Value estimates derived solely under this motivation, for example, may reflect only the "use value" of services provided by grown children and exclude the other positive effects of reducing risks to children, such as higher future utility experienced by the child himself or herself. In this example, a parental decisionmaker would generally underestimate the full value to the child of reducing his or her risks because certain aspects of the child's preferences are not reflected in parental decision making. A similar outcome could result from parents' choices regarding a child's intertemporal tradeoffs if parents discount their child's future consumption more highly than they do their own. There is relatively little empirical evidence that this is the case, but research in this area has only just begun.<sup>(29,31)</sup>

Parental values for reducing a child's risk can also reflect paternalistic altruism. To the extent that parents' choices reflect this kind of altruism, their choices may not be utility maximizing for the child because they are providing relatively more of these commodities than what the child himself or herself would desire in the long run. These considerations may result in upwardly biased values for childhood risk reductions.

A related issue concerns parents who might not possess complete information regarding children's health and safety risks. For instance, uninformed parents might not be aware of the impact some of their own actions have on the welfare of their child and may engage in actions that contribute to illness or injury in their own children. Some of these actions have been noted in the literature and they include parental smoking, failure of parents to manage childhood asthma, and resistance to the use of child safety seats.<sup>(29)</sup> Of course, a similar concern could be raised regarding adult ignorance of the consequences of their own actions to their own health, including the detrimental effects of smoking and the failure to wear safety belts while driving. However, when parents act as intermediaries, representing their children's interests, the likelihood of ignorance seems greater since the parents do not necessarily experience health consequences identical to those of their children.

Certain information deficiencies and motivations not aligned with the children's best interests are likely to affect parental decision making in a few "extreme" cases only. In general, these cases pose little concern from a valuation standpoint since economic values used in benefit-cost analyses are estimated by averaging over a large number of individuals. However, if these qualities were present in large segments of the parent population, the resulting values may not be appropriate for policy analysis.

#### 4. IMPLICATIONS FOR POLICY AND RESEARCH

By executive order, policymakers must identify and assess health and safety risks that disproportionately affect children. Regulations with national economic impacts exceeding \$100 million per year must be accompanied by evaluations of the regulations' effects on children. These directives highlight the need for better information on how to value the benefits of reduced health and safety risks to children.

The limited empirical estimates of reduced risk to children are a valuable resource for regulatory analysts. Employing these estimates necessarily raises key questions about the appropriate perspective for assessing children's health benefits. While the adults-as-children perspective may be better aligned with the welfare economic paradigm that underlies benefit-cost analysis in that the values estimated represent the behaviors and preferences of those receiving the benefits, little work has been done to date to develop the theoretical underpinnings of this approach. Furthermore, application of this approach may prove difficult, depending on the scenario. Approaches based on parental perspectives, including household production and intra-household allocation models, are based on stronger theoretical models; however, values are ultimately obtained from third-party proxies (parents) rather than the individual facing the risk (the child). Currently, parental perspective models are the most straightforward and advantageous to implement. Until more research becomes available on the appropriateness of alternative models and the validity of their resulting values, however, it will remain unclear which perspective should be pursued.

A recent example illustrates that the issue of perspective is not merely an academic concern, and that choices about perspective may affect the outcome of regulatory benefit-cost analyses. The U.S. Department of Housing and Urban Development (HUD) and the U.S. Environmental Protection Agency (EPA) have each recently set standards for lead-based paint in housing, and both agencies calculated the benefits of reduced lead burden in children by estimating the impact of blood lead on IQ, and then the impact of IQ on life-time earnings.<sup>(32)</sup> Lutter<sup>(33)</sup> re-examines the benefits of avoiding IQ reductions by drawing upon a study that estimates parents' willingness to pay for chelation therapy, a treatment that reduces the blood lead burdens of children with high blood lead levels.<sup>(25)</sup> The WTP estimates produced by Lutter range from \$1,100 to \$1,900 per lost IQ point. HUD and EPA estimate that reduced income over the lifetime of the child is about \$8,800 per lost IQ point. While technical issues and assumptions may account for some of this discrepancy, Lutter suggests that a principle reason for the difference is that his estimates are benefits to *parents*, whereas the HUD/EPA estimates are benefits to *children*. In essence, the Lutter approach adopts a parental

perspective while the HUD/EPA approach is closer to an “adult-as-child” perspective for valuation.

But does the choice of perspective matter? In the case of these lead standards, net benefits are positive from the adult-as-child perspective and negative under the parental perspective. The choice of perspective in this case appears to determine whether the rule is considered efficient, and therefore economically desirable.<sup>4</sup>

In the short term, however, this embarrassment of riches with regards to data will be an infrequent occurrence. To date the economics literature contains very few WTP estimates of the value of reducing health and safety risks to children. Of the few estimates that exist, most represent the parental perspective. Future research that sets out to measure values of childhood risk from both the parental and adult-as-child perspective would shed additional light on the importance of perspective and on the direction of difference between the two perspectives.

For now, in many cases, analysts will have available estimates of avoided costs of illness to draw upon, but for benefit-cost analysis such estimates are less desirable than WTP measures. This leaves regulatory analysts with little choice but to attempt to value reduced health risks to children by drawing from existing WTP estimates obtained for adult populations. To carefully make this benefit transfer requires analysts to consider the appropriate perspective for analysis. For example, adoption of an “adult-as-child” perspective may require an adjustment for life-time wealth differences between the current generation of adults and their children. Reliance on parental preferences does not require this adjustment, but puts particular pressure on the analyst to determine the extent to which parents fully incorporate their child’s utility functions into their own.

Children’s health issues are receiving more regulatory attention and policymakers have demanded analyses that more fully address the risk and economic impacts on children. It is now up to economists and risk assessors to supply meaningful information for use in benefit assessments. By

thinking carefully about the perspective adopted in the value estimates, and the sources for systematic differences in adult and child values, economists can better inform discussions of actions that reduce risks to children and promote more efficient children’s health policies.

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<sup>4</sup>Lutter notes that there are also equity considerations raised in this case because adults would be paying for the lead reductions but children, who as a generation are presumably wealthier, would be enjoying the benefits. The regulation is therefore a transfer from the current generation of adults to the next generation of adults. While such concerns about equity should be considered in any policy context, they are generally distinct from conclusions about the efficiency of the program.

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